

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Currently Amended) A display apparatus having a plurality of electron emitters arrayed in association with a plurality of pixels, for emitting electrons from the electron emitters to display an image, each electron emitter including a first electrode and a second electrode in direct contact with said electron emitter, wherein:
necessary charges are accumulated in all the electron emitters in a first period;
and
a voltage required to emit electrons is applied to all the electron emitters to cause a plurality of electron emitters which correspond to pixels to emit light therefrom, for emitting light from said pixels, in a second period after said first period;
and
light is emitted from said pixels only during said second period.
2. (Original) A display apparatus according to claim 1, characterized by:
a drive circuit for scanning all the electron emitters to apply necessary voltages to the electron emitters;
wherein one image is displayed in a period as one frame, said one frame including said first period and said second period;
wherein said drive circuit scans all said electron emitters and applies accumulation voltages depending on the luminance levels of corresponding pixels to the electron emitters which correspond to pixels to emit light therefrom in said first period, and applies a constant emission voltage to all the electron emitters in the second period after said first period;
wherein charges in amounts depending on the luminance levels of corresponding pixels are accumulated in the electron emitters which correspond to

pixels to emit light therefrom in said first period; and

wherein electrons are emitted in amounts depending on the luminance levels of corresponding pixels from the electron emitters which correspond to pixels to emit light therefrom in said second period, thereby emitting light from the pixels.

3. (Withdrawn) A display apparatus according to claim 1, characterized by:

a drive circuit for scanning all the electron emitters to apply necessary voltages to the electron emitters;

wherein one image is displayed in a period as one frame, said one frame being divided into a plurality of periods having respective different luminance levels, each of said periods serving as one subfield, said one subfield including said first period and said second period;

wherein said drive circuit scans all said electron emitters and applies a constant accumulation voltage to the electron emitters to emit light therefrom in said first period, and applies emission voltages depending on luminance levels assigned to the subfields to all said electron emitters in the second period after said first period;

wherein a constant amount of charges are accumulated in the electron emitters to emit light therefrom in said first period; and

wherein electrons are emitted in amounts depending on the luminance levels assigned to the subfields from the electron emitters which correspond to pixels to emit light therefrom in said second period, thereby emitting light from the pixels.

4. (Withdrawn) A display apparatus according to claim 1, characterized by:

a drive circuit for scanning all the electron emitters to apply necessary voltages to the electron emitters;

wherein one image is displayed in a period as one frame, said one frame being divided into a plurality of periods having respective different luminance levels, each of said periods serving as one subfield, said one subfield including said first period and said second period;

wherein said drive circuit scans all said electron emitters and applies accumulation voltages depending on luminance levels assigned to the subfields to the electron emitters to emit light therefrom in said first period, and applies a constant emission voltage to all said electron emitters in the second period after said first period;

wherein charges in amounts depending on the luminance levels assigned to the subfields are accumulated in the electron emitters to emit light therefrom in said first period; and

wherein electrons are emitted in amounts depending on the luminance levels assigned to the subfields from the electron emitters which correspond to pixels to emit light therefrom in said second period, thereby emitting light from the pixels.

5. (Withdrawn) A display apparatus according to claim 1, characterized by:

a drive circuit for scanning all the electron emitters to apply necessary voltages to the electron emitters;

wherein one image is displayed in a period as one frame, said one frame being divided into a plurality of periods having the same luminance level, each of said periods serving as one linear subfield, said one linear subfield including said first period and said second period;

wherein said drive circuit scans all said electron emitters and applies a constant accumulation voltage to the electron emitters to emit light therefrom in said linear subfields in said first period, and applies a constant emission voltage to all said electron emitters in the second period after said first period;

wherein a constant amount of charges are accumulated in the electron emitters to emit light therefrom in said linear subfields in said first period; and

wherein a constant amount of electrons are emitted from the electron emitters which correspond to pixels to emit light therefrom in the linear subfields in said second period, thereby emitting light from the pixels.

6. (Withdrawn) A display apparatus according to claim 1, characterized by:
a drive circuit for scanning all the electron emitters to apply necessary voltages to the electron emitters;

wherein one image is displayed in a period as one frame, said one frame including said first period and said second period;

wherein said drive circuit applies a constant accumulation voltage to all said electron emitters in said first period, and scans all said electron emitters and applies emission voltages depending on the luminance levels of corresponding pixels to the electron emitters which correspond to pixels to emit light therefrom in said second period after said first period;

wherein a constant amount of charges are accumulated in all said electron emitters in said first period; and

wherein electrons are emitted in amounts depending on the luminance levels of corresponding pixels from the electron emitters which correspond to pixels to emit light therefrom in said second period, thereby emitting light from the pixels.

7. (Withdrawn) A display apparatus according to claim 1, characterized by:
a drive circuit for scanning all the electron emitters to apply necessary voltages to the electron emitters;

wherein one image is displayed in a period as one frame, said one frame being divided into a plurality of periods having respective different luminance levels, each of said periods serving as one subfield, said one subfield including said first period and said second period;

wherein said drive circuit applies accumulation voltages depending on luminance levels assigned to the subfields to all said electron emitters to emit light therefrom in said first period, and scans all said electron emitters and applies a constant emission voltage to said electron emitters to emit light therefrom in the second period after said first period;

wherein charges in amounts depending on the luminance levels assigned to the subfields are accumulated in all said electron emitters in said first period; and

wherein electrons are emitted in amounts depending on the luminance levels assigned to the subfields from the electron emitters which correspond to pixels to emit light therefrom in said second period, thereby emitting light from the pixels.

8. (Withdrawn) A display apparatus according to claim 1, characterized by:
a drive circuit for scanning all the electron emitters to apply necessary voltages to the electron emitters;

wherein one image is displayed in a period as one frame, said one frame being divided into a plurality of periods having respective different luminance levels, each of said periods serving as one subfield, said one subfield including said first period and said second period;

wherein said drive circuit applies a constant accumulation voltage to all said electron emitters in said first period, and scans all said electron emitters and applies emission voltages depending on the luminance levels assigned to the subfields to the electron emitters to emit light therefrom in said second period after said first period;

wherein a constant amount of charges are accumulated in all said electron emitters in said first period; and

wherein electrons are emitted in amounts depending on the luminance levels assigned to the subfields from the electron emitters which correspond to pixels to emit light therefrom in said second period, thereby emitting light from the pixels.

9. (Withdrawn) A display apparatus according to claim 1, characterized by:
a drive circuit for scanning all the electron emitters to apply necessary voltages to the electron emitters;

wherein one image is displayed in a period as one frame, said one frame being divided into a plurality of periods having the same luminance level, each of said periods serving as one linear subfield, said one linear subfield including said first period and said second period;

wherein said drive circuit applies a constant accumulation voltage to all said electron emitters in said first period, and scans all said electron emitters and applies a constant emission voltage to the electron emitters to emit light therefrom in the linear subfields in said second period after said first period;

wherein a constant amount of charges are accumulated in the electron emitters to emit light therefrom in the linear subfields in said first period; and

wherein a constant amount of electrons are emitted from the electron emitters which correspond to pixels to emit light therefrom in the linear subfields in said second period, thereby emitting light from the pixels.

10. (Original) A display apparatus according to claim 2, characterized in that said drive circuit comprises:

a pulse generating circuit for generating a pulse signal having a constant pulse amplitude; and

an amplitude modulating circuit for amplitude-modulating said pulse signal to generate said accumulation voltage in said first period.

11. (Original) A display apparatus according to claim 2, characterized in that said drive circuit comprises:

a pulse generating circuit for generating a pulse signal applicable to said electron emitters, said pulse signal having a voltage waveform including a positive-going edge or a negative-going edge which is continuously variable in level; and

a pulse width modulating circuit for pulse-width-modulating said pulse signal to generate said accumulation voltage in said first period.

12. (Withdrawn) A display apparatus according to claim 3, characterized in that said drive circuit comprises:
a pulse generating circuit for generating a pulse signal having a constant pulse amplitude; and
an amplitude modulating circuit for amplitude-modulating said pulse signal to generate said emission voltage in said second period.
13. (Withdrawn) A display apparatus according to claim 3, characterized in that said drive circuit comprises:
a pulse generating circuit for generating a pulse signal applicable to said electron emitters, said pulse signal having a voltage waveform including a positive-going edge or a negative-going edge which is continuously variable in level; and
a pulse width modulating circuit for pulse-width-modulating said pulse signal to generate said emission voltage in said second period.
14. (Previously Presented) A display apparatus according to claim 1, wherein said electron emitters have such characteristics that the electron emitters change to a first state in which electrons are accumulated when an electric field is applied in one direction to said electron emitters, and change from said first state to a second state in which electrons are emitted when an electric field is applied in another direction to said electron emitters, and a drive circuit is controlled to apply a voltage between a voltage for changing the electron emitters to said first state and a voltage for changing the electron emitters to a state immediately prior to said second state, to electron emitters which are unselected.
15. (Withdrawn) A display apparatus according to claim 2, characterized in that said electron emitters are selected and unselected through corresponding select lines; and

said drive circuit places the select lines of electron emitters which are unselected into a high impedance state.

16-18. (Cancelled).

19. (Currently Amended) A method of driving a display apparatus having a plurality of electron emitters arrayed in association with a plurality of pixels, for emitting electrons from the electron emitters to display an image, each electron emitter including a first electrode and a second electrode in direct contact with said electron emitter, said method comprising:

the step of accumulating necessary charges in all the electron emitters in a first period; and

the step of applying a voltage required to emit electrons to all the electron emitters to cause a plurality of electron emitters which correspond to pixels to emit light therefrom, for emitting light from said pixels, in a second period after said first period,

wherein light is emitted from said pixels only during said second period.

20. (Original) A method for driving a display apparatus according to claim 19, characterized in that

one image is displayed in a period as one frame, said one frame including said first period and said second period; and characterized by

the step of scanning all said electron emitters, and applying accumulation voltages depending on the luminance levels of corresponding pixels to the electron emitters which correspond to pixels to emit light therefrom in said first period, to accumulate charges in amounts depending on the luminance levels of corresponding pixels in the electron emitters which correspond to pixels to emit light therefrom in said first period; and

the step of applying a constant emission voltage to all the electron emitters in the second period after said first period, to emit electrons in amounts depending on the luminance levels of corresponding pixels from the electron emitters which correspond to pixels to emit light therefrom in said second period, thereby emitting light from the pixels.

21. (Withdrawn) A method for driving a display apparatus according to claim 19, characterized in that

one image is displayed in a period as one frame, said one frame being divided into a plurality of periods having respective different luminance levels, each of said periods serving as one subfield, said one subfield including said first period and said second period; and characterized by

the step of scanning all said electron emitters, applying a constant accumulation voltage to the electron emitters to emit light therefrom in said first period, to accumulate a constant amount of charges in the electron emitters to emit light therefrom in said first period; and

the step of applying emission voltages depending on luminance levels assigned to the subfields to all said electron emitters in the second period after said first period, to emit electrons in amounts depending on the luminance levels assigned to the subfields from the electron emitters which correspond to pixels to emit light therefrom in said second period, thereby emitting light from the pixels.

22. (Withdrawn) A method for driving a display apparatus according to claim 19, characterized in that

one image is displayed in a period as one frame, said one frame being divided into a plurality of periods having respective different luminance levels, each of said periods serving as one subfield, said one subfield including said first period and said second period; and characterized by

the step of scanning all said electron emitters, and applying accumulation voltages depending on luminance levels assigned to the subfields to the electron emitters to emit light therefrom in said first period, to accumulate charges in amounts depending on the luminance levels assigned to the subfields in the electron emitters to emit light therefrom in said first period; and

the step of applying a constant emission voltage to all said electron emitters in the second period after said first period, to emit electrons in amounts depending on the luminance levels assigned to the subfields from the electron emitters which correspond to pixels to emit light therefrom in said second period, thereby emitting light from the pixels.

23. (Withdrawn) A method for driving a display apparatus according to claim 19, characterized in that

one image is displayed in a period as one frame, said one frame being divided into a plurality of periods having the same luminance level, each of said periods serving as one linear subfield, said one linear subfield including said first period and said second period; and characterized by

the step of scanning all said electron emitters, and applying a constant accumulation voltage to the electron emitters to emit light therefrom in said linear subfields in said first period, to accumulate a constant amount of charges in the electron emitters to emit light therefrom in said linear subfields in said first period; and

the step of applying a constant emission voltage to all said electron emitters in the second period after said first period, to emit a constant amount of electrons from the electron emitters which correspond to pixels to emit light therefrom in the linear subfields in said second period, thereby emitting light from the pixels.

24. (Withdrawn) A method for driving a display apparatus according to claim 19, characterized in that

one image is displayed in a period as one frame, said one frame including said first period and said second period; and characterized by

the step of applying a constant accumulation voltage to all said electron emitters in said first period to accumulate a constant amount of charges in all said electron emitters in said first period; and

the step of scanning all said electron emitters and applying emission voltages depending on the luminance levels of corresponding pixels to the electron emitters which correspond to pixels to emit light therefrom in said second period after said first period, to emit electrons in amounts depending on the luminance levels of corresponding pixels from the electron emitters which correspond to pixels to emit light therefrom in said second period, thereby emitting light from the pixels.

25. (Withdrawn) A method for driving a display apparatus according to claim 19, characterized in that

one image is displayed in a period as one frame, said one frame being divided into a plurality of periods having respective different luminance levels, each of said periods serving as one subfield, said one subfield including said first period and said second period; and characterized by

the step of applying accumulation voltages depending on luminance levels assigned to the subfields to all said electron emitters to emit light therefrom in said first period, to accumulate charges in amounts depending on the luminance levels assigned to the subfields in all said electron emitters in said first period; and

the step of scanning all said electron emitters and applying a constant emission voltage to said electron emitters to emit light therefrom in the second period after said first period, to emit electrons in amounts depending on the luminance levels assigned to the subfields from the electron emitters which correspond to pixels to emit light therefrom in said second period, thereby emitting light from the pixels.

26. (Withdrawn) A method for driving a display apparatus according to claim 19, characterized in that

one image is displayed in a period as one frame, said one frame being divided into a plurality of periods having respective different luminance levels, each of said periods serving as one subfield, said one subfield including said first period and said second period; and characterized by

the step of applying a constant accumulation voltage to all said electron emitters in said first period, to accumulate a constant amount of charges in all said electron emitters in said first period; and

the step of scanning all said electron emitters and applying emission voltages depending on the luminance levels assigned to the subfields to the electron emitters to emit light therefrom in said second period after said first period, to emit electrons in amounts depending on the luminance levels assigned to the subfields from the electron emitters which correspond to pixels to emit light therefrom in said second period, thereby emitting light from the pixels.

27. (Withdrawn) A method for driving a display apparatus according to claim 19, characterized in that

one image is displayed in a period as one frame, said one frame being divided into a plurality of periods having the same luminance level, each of said periods serving as one linear subfield, said one linear subfield including said first period and said second period; and characterized by

applying a constant accumulation voltage to all said electron emitters in said first period, to accumulate a constant amount of charges in the electron emitters to emit light therefrom in the linear subfields in said first period; and

the step of scanning all said electron emitters and applying a constant emission voltage to the electron emitters to emit light therefrom in the linear subfields in said second period after said first period, to emit a constant amount of electrons from the electron emitters which correspond to pixels to emit light therefrom in the linear subfields in said second period, thereby emitting light from the pixels.

28. (Original) A method for driving a display apparatus according to claim 20, characterized in that

a pulse signal having a constant pulse amplitude is generated; and
said pulse signal is amplitude-modulated to generate said accumulation voltage in said first period.

29. (Original) A method for driving a display apparatus according to claim 20, characterized in that

a pulse signal applicable to said electron emitters is generated, said pulse signal having a voltage waveform including a positive-going edge or a negative-going edge which is continuously variable in level; and

said pulse signal is pulse-width-modulated to generate said accumulation voltage in said first period.

30. (Withdrawn) A method for driving a display apparatus according to claim 21, characterized in that

a pulse signal having a constant pulse amplitude is generated; and
said pulse signal is amplitude-modulated to generate said emission voltage in said second period.

31. (Withdrawn) A method for driving a display apparatus according to claim 21, characterized in that

a pulse signal applicable to said electron emitters is generated, said pulse signal having a voltage waveform including a positive-going edge or a negative-going edge which is continuously variable in level; and

said pulse signal is pulse-width-modulated to generate said emission voltage in said second period.

32. (Previously Presented) A method for driving a display apparatus according to claim 19, characterized in that

said electron emitters have such characteristics that the electron emitters change to a first state in which electrons are accumulated when an electric field is applied in one direction to said electron emitters, and change from said first state to a second state in which electrons are emitted when an electric field is applied in another direction to said electron emitters; and

a voltage between a voltage for changing the electron emitters to said first state and a voltage for changing the electron emitters to a state immediately prior to said second state, is applied to electron emitters which are unselected.

33. (Withdrawn) A method of driving a display apparatus according to claim 19, characterized in that

said electron emitters are selected and unselected through corresponding select lines; and

the select lines of electron emitters which are unselected are placed into a high impedance state.

34-36. (Cancelled).

37. (Currently Amended) An electron emitter comprising:

a first electrode and a second electrode in direct contact with said electron emitter, wherein:

charges required for electron emission are accumulated in a first period; ~~and~~

a voltage required for electron emission is applied to emit electrons in an amount depending on the accumulated charges in a second period after said first period; and

electrons are emitted from said electron emitter only during said second period.

38. (Cancelled).

39. (Currently Amended) An electron emission apparatus having a plurality of electron emitters, each electron emitter including a first electrode and a second electrode in direct contact with said electron emitter, wherein:

charges required for electron emission are accumulated in all the electron emitters in a first period; ~~and~~

a voltage required for electron emission is applied to all the electron emitters to emit electrons in an amount depending on the charges accumulated in said electron emitters in a second period after said first period; and

electrons are emitted from said electron emitter only during said second period.

40. (Original) An electron emission apparatus according to claim 39, characterized in that

accumulation voltages depending on charges to be accumulated in said electron emitters are applied in said first period; and

a constant emission voltage is applied to all said electron emitters in the second period after said first period.

41. (Original) An electron emission apparatus according to claim 40, characterized by

a pulse generating circuit for generating a pulse signal having a constant pulse amplitude; and

an amplitude modulating circuit for amplitude-modulating said pulse signal to generate said accumulation voltage in said first period.

42. (Original) An electron emission apparatus according to claim 40, characterized by

a pulse generating circuit for generating a pulse signal applicable to said electron emitters, said pulse signal having a voltage waveform including a positive-going edge or a negative-going edge which is continuously variable in level; and

a pulse width modulating circuit for pulse-width-modulating said pulse signal to generate said accumulation voltage in said first period.

43-45. (Cancelled).

46. (Previously Presented) An electron emission apparatus according to claim 39, characterized in that

said electron emitters have such characteristics that the electron emitters change to a first state in which electrons are accumulated when an electric field is applied in one direction to said electron emitters, and change from said first state to a second state in which electrons are emitted when an electric field is applied in another direction to said electron emitters;

said apparatus further comprising a drive circuit for applying a voltage between a voltage for changing the electron emitters to said first state and a voltage for changing the electron emitters to a state immediately prior to said second state, to electron emitters which are unselected.

47. (Currently Amended) A method of driving an electron emitter that includes a first electrode and a second electrode in direct contact with said electron emitter, said method comprising:

the step of accumulating charges required for electron emission in a first period; and

the step of applying a voltage required for electron emission to emit electrons in an amount depending on the accumulated charges in a second period after said first period,

wherein electrons are emitted from said electron emitter only during said second period.

48. (Currently Amended) A method of driving a plurality of electron emitters each having a first electrode and a second electrode in direct contact with said electron emitter, said method comprising:

selecting at least one electron emitter from the electron emitters and emitting electrons from the selected electron emitter wherein:

said electron emitters have such characteristics that the electron emitters change to a first state in which electrons are accumulated when an electric field is applied in one direction to said electron emitters, and change from said first state to a second state in which electrons are emitted when an electric field is applied in another direction to said electron emitters; and

a voltage between a voltage for changing the electron emitters to said first state and a voltage for changing the electron emitters to a state immediately prior to said second state, is applied to electron emitters which are unselected among the plurality of electron emitters; and

electrons are emitted from said electron emitter only during said second period.

49. (Currently Amended) A method of driving an electron emission apparatus having a plurality of electron emitters each having a first electrode and a second electrode in direct contact with said electron emitter, said method comprising:

accumulating charges required for electron emission in all the electron emitters in a first period; and

applying a voltage required for electron emission to all the electron emitters to emit electrons in an amount depending on the charges accumulated in said electron emitters in a second period after said first period,

wherein electrons are emitted from said electron emitter only during said second period.

50. (Original) A method of driving an electron emission apparatus according to claim 49, characterized in that

accumulation voltages depending on charges to be accumulated in said electron emitters are applied in said first period; and

a constant emission voltage is applied to all said electron emitters in the second period after said first period.

51. (Original) A method of driving an electron emission apparatus according to claim 50, characterized in that

a pulse signal having a constant pulse amplitude is amplitude-modulated to generate said accumulation voltage in said first period.

52. (Original) A method of driving an electron emission apparatus according to claim 50, characterized in that

a pulse signal applicable to said electron emitters is generated, said pulse signal having a voltage waveform including a positive-going edge or a negative-going edge which is continuously variable in level; and

said pulse signal is pulse-width-modulated to generate said accumulated voltage in said first period.

53-55. (Cancelled).

56. (Previously Presented) A method of driving an electron emission apparatus according to claim 49, characterized in that

said electron emitters have such characteristics that the electron emitters change to a first state in which electrons are accumulated when an electric field is applied in one direction to said electron emitters, and change from said first state to a second state in which electrons are emitted when an electric field is applied in another direction to said electron emitters; and

a voltage between a voltage for changing the electron emitters to said first state and a voltage for changing the electron emitters to a state immediately prior to said second state, is applied to electron emitters which are unselected.